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# Understanding Public Values and Attitudes Related to Ecological Risk Management

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## **Executive Summary**

This proposed research will identify and quantify values for important natural amenities of Tampa Bay. The value measures will provide direct input into decision making regarding the alternative programs to control nutrient inputs into Tampa Bay, and will put this into perspective of other programs to improve the environmental amenities of Tampa Bay.

This work is important for achieving continued progress in provision of important environmental amenities. Although recent years have seen much progress in protection and restoration of critical environmental amenities, many significant impacts and threats remain. Limited resources are available to resolve these issues, and competing social needs necessitates that management actions focus on resolving the highest priority issues in a cost effective manner. Simultaneously, communities are becoming increasingly resistant to management solutions imposed from “outside”. Continued progress towards achieving environmental improvement depends on establishing consensus management strategies that focus efforts towards addressing the key objectives at reasonable cost.

It is critically important that public values be represented in environmental decisions process, since public money is to be used to fund resource protection activities, the public will ultimately bear the costs management actions that increase cost to industry, and since under the Public Trust Doctrine, government managers are mandated to act as trustees for the public. This sets forth a challenge to identify the key environmental objectives of the community more clearly, and to focus management on the highest priority goals of the community, which underscores the importance of efforts to elicit priorities and values of the affected communities. Social scientists have much to contribute to these issues, having invested substantial research efforts towards understanding processes to identify and measure public values, and processes to develop consensus agreements among interested parties.

Measuring community environmental values in a way that can contribute to assessment of specific management actions is an inherently difficult task, and not one that is amenable to routine application of standard techniques. For example, it is a difficult task to determine how much people care about reducing nitrogen deposition in Tampa Bay, and what level of expenditure of public dollars is justified to support specific programs. The complex scientific nature of the problem also contributes to the challenges faced in this task.

A flexible approach is essential in order to focus on the most critical issues and controversies faced by the community, and to design an instrument that respondents can understand and that elicits values for key Tampa Bay amenities. Therefore, it is important not commit prematurely to a specific instrument design. Rather, the research process must first obtain a firm understanding of the key issues and controversies from the perspective of the various communities, and steps must be taken to design an effective survey instrument.

Thus, rather than simply applying a predetermined set of economic tools, we will set forth a research process to identify public values regarding critical natural amenities of Tampa Bay. First, we will obtain and carefully study documents that describe the critical issues faced in Tampa Bay in order to obtain background information on the problems faced. Much of this work has already been completed as part of developing the present proposal. The second stage of the research is to meet with the various interested parties to get a more detailed understanding of the important issues from various perspectives, and particularly to identify the important controversies. The goal of this stage in the process is to expand our knowledge base on critical Tampa Bay issues and, just as importantly, to develop a working relationship with the various parties. The next stage in the research will develop a list and description of important values concerning Tampa Bay amenities, and identify those that can reasonably be addressed within the context of the proposed study. We will then meet with Tampa Bay management teams to describe the values that will be estimated. This will be the final opportunity for input from the management team on the essential elements of the study, and we maintain flexibility up to this stage, so that values measured by the research efforts can be of highest utility to the management team.

Once we have come to agreement with the management council on the final set of values to be estimated, we will organize and implement a set of focus groups and, later, a set of verbal protocols with the goal of developing a survey instrument to measure important public values. Initial focus groups will involve general discussions of the issues of concern, and will be used to understand the perspective of participants, to identify how they think about issues, what language they use, which words are loaded or likely to be misunderstood, what kinds of background information needs to be provided, whether they care about the particular issues, and if so why. As the process moves along, more time will be spent on specific issues identified to be important to the developing survey and pretesting successive draft questions. The focus groups will include considerable discussion of the questions to ensure that participants understand the questions, and that the survey responses convey the information we are attempting to elicit.

These focus groups will provide excellent qualitative information that is useful for understanding values held by focus group participants. More importantly, the focus groups will provide essential insights that help to identify difficulties in survey questions, and suggest approaches that can be used to improve the survey design.

When we feel we have a workable draft survey, we will implement a set of verbal protocols on the draft instrument. Verbal protocols are carried out by having an individual complete the survey, while “talking aloud” to express what the individual is thinking about while answering the questions. This will provide additional insights into the thought process underlying the survey format, and the survey will be revised as appropriate, until investigators are confident that the survey provides the information being sought.

When the survey development process is complete, we will implement the survey using a sample of the public. The precise format of the survey will be determined through the rigorous survey development process described above, and we strongly recommend that we maintain the flexibility to determine the best survey instrument and means of implementation. However, we anticipate that the survey will be administered as an in-person, self-administered survey. We also anticipate that adequate funds will not be available for probability sampling, and we can use standard weighting procedures to correct for non-representative samples, to the extent possible. We will also apply standard rationality tests to confirm that results of the survey indicate valid economic values.

The results of the survey will provide an assessment of public values for important amenities of Tampa Bay and will link with available scientific studies to provide direct input into management options. We will carry out various “rationality tests” to confirm that the survey results are valid measures of values of specific amenities described and not, for example, symbolic expressions of concern for the environment, in general. The results are analogous to public referenda, but are much more informative to policy makers and are more flexible. As such, the results will provide essential public input into the management process and ensure that public values are represented in the public decision process.

## **Specific Aims**

The proposed research has the following general objectives:

1. Improve our understanding of the important dimensions of values that the public holds for environmental amenities,
2. Obtain qualitative information regarding why the public cares about Tampa Bay amenities,
3. Identify and quantify public values for important natural amenities of Tampa Bay,
4. Use these value estimates to assess specific policy options available for managing the Tampa Bay environment.

The discussion below will outline a research process to identify a set of economic tools for measuring qualitative and quantitative aspects of values that the public hold for Tampa Bay environmental amenities. Detailed information will be obtained regarding the various issues of importance from different perspectives, and the critical controversies that are faced in managing Tampa Bay resources. This information will be both in qualitative and quantitative form.

We anticipate that the values to be assessed will include use values and non-use values. Use values that we potentially will estimate include values associated with recreational uses, such as swimming, fishing, boating and wildlife viewing, aesthetic qualities of the bay and commercial uses. Non-use values will include individual's values associated with maintaining Tampa Bay natural amenities that go beyond specific uses. The final selection of values to include will depend upon their importance to managers and the community as indicated in interviews and focus groups, and the extent to which the values are relevant to assessing specific management policies.

A quantitative assessment will be obtained for amenable values that are identified as most critical to determining the best set of management actions. The results of economic survey methods are analogous to a public referendum, except that surveys allow more flexibility in assessing public support for programs that vary in terms of (1) amenities considered, (2) the degree of environmental protection and (3) the cost of the program. For example, the output of an economic analysis could inform policy makers on the fraction of the public that would support alternative sets of programs to protect environmental amenities. The results can also be used to identify the public input regarding the "best" set of policy actions to be instituted within a given budget. These quantitative value measures can be used to assess specific control policies, thereby providing management teams with specific information that is directly applicable to important policy questions that they face.

## **Background and Significance**

Tampa Bay is the largest open-water estuary in Florida, spanning about 400 square miles within a 2,200 square mile watershed. The estuary supports many species of fish and wildlife ranging from mammals like manatees and bottlenose dolphins, to birds like pelicans and ibis, to fish species like snook and red drum. Mangroves in Tampa Bay serve as breeding grounds for 25 bird species, including pelicans, egrets, herons, cormorants, terns, ibis and spoonbills. Many other birds winter in Tampa Bay, including as the American white pelican and several species of sandpipers. Tampa Bay supports commercial and recreational uses, and provides natural amenities to the population of over 2 million that reside in the surrounding area.

However, population growth surrounding Tampa Bay threatens the very amenities that drew people to the area in the first place. The most significant adverse impacts to the bay occurred from about 1950 through the about 1980, due primarily to pollution and to dredge and fill operations. Excess nutrients entering the bay have led to algae blooms that reduce visibility and oxygen levels in the bay, adversely affecting habitat quality. Seagrasses that provide habitat for many species of fish and shellfish are particularly sensitive to

problems resulting from excess nutrients. Over half of the bay's historic seagrass beds have been lost, contributing to a decline in the bay's commercial and recreational fisheries. Scallops have virtually disappeared from the bay, and other shellfish harvests were sharply curtailed due to bacterial contamination. Many species of birds have also suffered a sharp decline.

Restoring habitats that were damaged in the past, and protecting existing habitats is vital to maintaining many bay functions. Starting in the late 1970's, large investments were made to improve the Tampa Bay environment, including upgrading wastewater treatment facilities and increased water recycling, aimed at reducing nutrient inputs into the bay. These efforts have improved water in the bay, and significant recovery of seagrass beds has resulted. These habitat improvements, combined with steps to manage fisheries, have helped to reverse the decline in important fish species such as snook and red drum.

But despite many successes to date, the bay still suffers from significant environmental impacts and threats, particularly from excess nutrients and toxic pollutants. Continued growth in the area is expected to lead to an increase in nutrient loadings into the bay. Recent studies have also revealed that atmospheric deposition of nitrogen is a far more significant source of nutrients than was previously believed. Together, these threaten to reverse the gains made to date unless further control actions are taken.

The Tampa Bay Estuary Program (TBEP) was formed in 1991 under the National Estuaries Program (NEP) in response to these impacts and threats of future impacts to bay resources. The NEP was created to help develop a consensus among stakeholder groups to contribute to management of estuaries of national importance. A hallmark of the NEP is direct involvement of all interested parties, including the public, as partners in the management process, and integration of science into these types of public decision processes.

Under the TBEP a plan was developed to manage environmental resources in Tampa Bay (Tampa Bay Estuary Program, 1998). Among the most prominent of the initiatives in the plan was control of nitrogen inputs as a means of restoring seagrass beds. Seagrass beds were targeted both because of their ecological importance as habitat and as a barometer of overall quality of the bay's waters. A follow up joint effort by local governments, agencies, and industries in the region developed a specific plan of action (Tampa Bay Nitrogen Management Consortium, 1999) to implement the nitrogen management elements of the Tampa Bay management plan.

To date, little work is available to assess values within Tampa Bay. The proposed research will apply economic methods for measuring public values, and for integrate values into the public decision process in Tampa Bay. The economics literature on valuation methods is enormous, and this brief background section will not attempt a comprehensive assessment of the state of the art. Rather, it will provide a brief review of the concepts and methods as they pertain to issues faced in Tampa Bay, will discuss how these concepts are relevant to the present effort and will discuss one comprehensive economic study that applies a series of economic methods to assess environmental amenities as part of the Peconic Estuary Program on Long Island, New York (Opaluch et al, 1993).

Economists generally divide values into use values and non-use values (or "Passive use" values). Use values are generally associated with an activity that involves the amenity. For example, recreational swimming embodies a use value for clean water. Similarly, a use value may be obtained by traveling to see the Grand Canyon. Non-use values are values that are associated with an amenity even if you do not use it. For example, I may hold a value for continued existence of the Grand Canyon in its natural state, even if I never expect to see it. Residents of Tampa Bay communities might value environmental improvements, above and beyond their potential uses of the bay, and people from throughout the United States may value maintaining of manatee populations in Tampa Bay even if they will never see them.

As indicated above, Tampa Bay provides residents with a host of use and non-use values, and economists have developed tools for measuring each (e.g., Freeman, 1993; Mitchell and Carson, 1989). A comprehensive economic analysis for the Peconic Estuary Program, part of the NEP, applied several of these approaches to measure different categories of values for the Peconic Estuary (Opaluch et al, 1998). Given the size of the economic valuation literature, this proposal will discuss the approaches applied to the Peconic estuary as an illustration of how economic methods can and have been applied to assessing public values for environmental amenities.

The Peconic estuary economic studies used a multi-phased plan to assess various use and non-use values. Phase I of the study focused on market values associated with the estuary by carrying out an economic impact analysis of the Peconic estuary (Grigalunas and Diamantides, 1996). This phase was a modest effort that provided a perspective on the levels of economic activities that are supported by the estuary, in terms of number of establishments in different economic sectors, and the associated levels of employment and wages. A second element of the market analysis of phase I identified opportunities and constraints faced by potential mariculture operations in the estuary.

Phase II was comprised of a series of economic studies that focused on non-market values supported by the estuary (Opaluch et al, 1998). These studies were used to identify and estimate various components of values associated with natural amenities, and the results of the various studies can be combined together to assess values associated with specific management actions to protect and restore amenities.

Phase II included a recreational use study, a property value study, a wetlands productivity analysis, a resource valuation study. The recreation study used a survey to collect primary data to identify levels of various recreation activities supported by the estuary, and to collect detailed trip information. The Recreation study used this data to estimate values of various recreation activities, and how participation rates and values would change with given changes in the quality of recreation activities. This allowed us to calculate recreational benefits associated with policies, such as those that improve water quality or increase fish populations. Thus, the recreation survey can estimate values associated with recreational uses, but excludes other values, thereby necessitating additional methods to measure other values.

The property value study used standard methods to determine how various attributes contribute to the selling price of houses. The study included the usual attributes describing the house, such as the number

of rooms, square footage of the house, size of the lot, size of garage, etc. The study also included environmental attributes that the home owner would enjoy, such as nearby open space, farm lands, wetlands, etc. If homeowners enjoy services associated with these environmental amenities, then one would expect the price of a house to be bid up if it has special amenities. For example, if a house has an ocean view, then one would expect that people would be willing to pay more for that house than they would for a house identical in all other ways, but without an ocean view. Therefore, we would expect that the selling price for the house would be reflective of the potential homeowners' values associated with an ocean view. The property value study was used to estimate values associated with adjacent open space, wetlands and farmland, among other amenities. However, the housing prices only indicate amenity values received by home owners living adjacent to specific amenities. Thus, these values exclude other values associated with amenities, such as the value obtained by people visiting the area, etc.. So other methods are needed to capture other components of value.

The resource survey used conjoint analysis to estimate values associated with various environmental amenities, including open space, farmland, salt marsh, eelgrass, safe shell fishing areas. A sample of the public was presented with a pair of alternative programs to that would provide specific levels of protection for these resources at a stated cost, and respondents were asked which program they prefer, or whether they preferred "neither program". This study approximates a public referendum on protection of various environmental amenities.

In theory, such a study could capture all use and non-use values associated with these amenities. However, focus group participants indicate that respondents were not considering certain categories of values when answering the questions. For example, in terms of open space amenities, the respondents seemed to consider the value of open space as a "generic amenity" that affects the character of the region as a whole. But focus group participants but didn't consider amenity values to immediately adjacent landowners, nor did participants appear to consider possible water quality benefits that might result from reduced development. Therefore, to include all categories of values, this study had to be augmented with other studies, described in this section.

The various parts of the Phase II were combined together to estimate three components of values: the contribution to the open space throughout the region, which effects the overall the character of the community, the amenities provided to property owners who live immediately adjacent to each open space parcel and the contribution of undeveloped land to reducing point and non-point pollution, affecting use and nonuse values associated with changes in water quality. The resource survey was used to estimate the value of open space as a general amenity. The results of the property value study was used to estimate the amenity value to adjacent property owners. Finally, the work is currently being linked to ongoing water quality modeling efforts that will determine impacts of activities on water quality in the Peconic (Tetra Tech, 2000). The results of our recreation survey are being linked to this water quality model to determine the effects of loss of open space on the quality and quantity of recreation activities in the Peconic. Together, these three studies include a wide range of values for open space amenities.



## Research Design and Methods

Measuring community environmental values in a way that can contribute to assessment of specific management actions is an inherently difficult task, and not one that is amenable to routine application of standard techniques. For example, it is a difficult task to determine how much people care about reducing nitrogen deposition in Tampa Bay, and what level of expenditure of public dollars is justified to support specific programs. The complex technical issues regarding the problem also contribute to the challenging nature of the task.

Considerable judgment, based on experience and training of the investigators, is required to design and implement a process to provide defensible value estimates. And the creation of a strong research process is just as important as applying sound tools. Themes that are critical to the success of the research effort are establishing a two-way communication to obtain information on values, and to ensure that the information obtained be directly relevant to the critical management questions to be addressed. To do so, the research team will work in close cooperation with, and be sensitive to, the needs of the affected communities, including both the various publics and resource managers. Indeed, this research process is best viewed as a component of the larger program to develop consensus within the community, and therefore faces the same challenges. Addressing these challenges requires a sound research strategy, a strong research team with considerable experience, and a willingness to work actively with the program staff and with the various affected communities.

The research team must be aware of the unique aspects of the estuary and its communities. This includes the natural environment, the social environment of the people in the community and the political aspects of decision making and implementation. Thus, the process begins with a thorough grounding of the research team with the principal issues faced in the project area. First, the research team will obtain and thoroughly study various reports and background documents to familiarize themselves with the critical issues. Much of this work is already complete, as part of developing the present proposal. Obtaining this working knowledge prior to meeting with local groups will help researchers establish credibility, and facilitate their acceptance by the local communities as "knowledgeable insiders" rather than "naïve outsiders".

For example, our work in the Peconic estuary on Long Island, New York was facilitated by the fact that we were from southern Rhode Island, less than 50 miles away, and that we faced very similar issues related to water quality, tourism, rapid loss of undeveloped land, etc. One theme we frequently emphasized at various meetings was that we felt very much at home in the Peconic, coming from a similar environment that faced closely related issues. The researchers are part of the management process, and the success of the research effort is dependent upon similar issues related to developing a consensus decision process. Establishing a close working relationship with a firm basis of trust is an important part of a successful research process.

The next step in the process is to meet with the principal parties involved in the management process, including knowledgeable and involved members of the public. The goal of this stage is to develop a more thorough understanding of various perspectives regarding the important issues faced, to learn more about the larger research program in place upon which to build, to identify critical controversies that must be dealt with and to establish a close working relationship with the principal actors.

With this critical background information, researchers will identify the specific sets of values to be assessed, and the best tools for assessing those values. For the Tampa Bay case study of atmospheric deposition of nitrogen, values are associated with habitat, especially for seagrasses, improved water clarity, etc. Tampa Bay habitats support commercial and recreational uses, and provides natural amenities to the population of over 2 million that reside in the surrounding area. The estuary supports many species of fish and wildlife ranging from mammals like manatees and bottlenose dolphins, to birds like pelicans and ibis, to fish species like snook and red drum. Mangroves in Tampa Bay serve as breeding grounds for 25 bird species, including pelicans, egrets, herons, cormorants, terns, ibis and spoonbills. Many other birds winter in Tampa Bay, including as the American white pelican and several species of sandpipers.

But these values are best understood within the larger context of environmental and social needs of the area. So values associated with nitrogen deposition are best understood within the broader context of values for amenities of Tampa Bay, and indeed within the context of broader social values. Very different values are likely to be important for working class communities, versus urban poor, versus the upper middle class versus commercial fishermen. It is critically important to capture critical elements of values of all affected communities. For many extremely poor communities, subsistence fishing values can be of primary importance, while more affluent communities may place primary importance on the health of marine mammal populations or scenic vistas. These are very different types of values, and different methods may be most appropriate for measuring each, while avoiding double counting.

Given this critical background information, the specific values to be focused upon will be identified, and researchers will begin to identify appropriate economic methods for measuring each of these values. At this stage in the process, we will meet with Tampa Bay management teams to describe the values to be identified in a qualitative manner, and which values our quantitative analysis will focus on. This is the final opportunity for the input into the essential elements of the survey process.

Economic methods identify management-relevant values by focusing on explicit or implicit tradeoffs that are embodied in choices. Tradeoffs are faced, for example, when decision makers prioritize actions to reduce nutrient emissions within a limited budget. This key notion is recognized by the Tampa Bay Estuary Program in its stated goal to "ensure that increasingly limited public funds are spent in a manner that best benefits the bay and the people who live around it" (Tampa Bay Estuary Program (1998)). For example, values measured by economic methods can be used to determine the best set of actions for a given budget, where "best" is defined as those that are most consistent with the values of the communities. Economic analyses can provide useful input into decisions regarding management actions.

In order for the information to be of use for management purposes, it is critical that values be measured in a quantitative fashion. For example, an attitude study might find that the public cares more about manatee populations than fish populations. Yet there may be few management actions that are available to protect and restore manatees, and those programs might be both very expensive and not very effective. In contrast, there may be many inexpensive and highly effective programs to restore fish. The question then becomes whether it is of higher priority to spend public funds to make a small change in the population of manatees, or to make a much larger change in the population of fish. The quantitative assessments provided by economic methods provide useful input into this sort of decision faced by resource managers.

People hold both use and non-use values for amenities like clean waters or habitat of Tampa bay. Use values concern activities like fishing, swimming, boating, wildlife viewing, or enjoying views of the bay. Non-use values concern the values that people have for bay resources beyond their use. The people around Tampa Bay might hold values maintaining a clean bay that extend beyond their uses of the bay. Many people throughout the United States may hold non-use values for preserving manatee populations in Tampa Bay, even if they will never travel there to see them.

Our initial meetings and focus groups will be used to identify the extent to which each of these values are important to Tampa Bay communities, particularly with respect to use versus nonuse values. This will help to determine the appropriate tools to apply. Economists have developed tools for quantifying each of these types of values. Use values are generally associated with some sort of action (e.g., traveling to the beach). Data can be obtained on these activities, and values can be inferred from tradeoffs faced when taking that action. The first category of approaches is called "revealed preference" approaches, where actions reveal values or preferences. Revealed preference approaches include market approaches and non-market approaches, such as the travel cost approach, the hedonic property value approach and the household production approach. (see, e.g., Freeman, 1993)

Revealed preference approaches are based on data in the form of what people actually did in order to infer a value for the activity. If someone chooses to pay \$30 to go fishing on a charter boat, then the activity must be worth at least \$30 to them. If someone chooses to go on a \$50 charter that has a higher expected catch rate and is otherwise identical, then that difference in expected catch rate must be worth at least \$20 (\$50-\$30) to them. By observing participation rates at varying prices and qualities, revealed preference methods allow one to infer values for activities at different level of quality. This allows one to identify values regarding the number of days, as well as for changes in quality.

Application of economic methods is relatively straightforward for market activities, where people pay a price to participate. For activities with no explicit price (e.g., fishing from shore), implicit prices can sometimes be constructed. For example, if the individual has to travel to go fishing, then price of participating in recreational fishing is the cost of traveling to the site, including the implicit cost of the time spent traveling to the site. If an individual is willing to travel a longer distance to go fishing at a site with higher expected catch rates, they are revealing that they are willing to pay at least that additional cost for higher catch rates. If managers can estimate how policies to improve fish habitat can affect catch rates, then

revealed preference methods can identify the benefits that those policies provide to recreational fishing activities.

Nonuse values are not generally associated with any particular activity that can be measured. An individual might value knowing that manatees populations of Tampa Bay are protected, but simply enjoying that knowledge doesn't require any particular action by the individual, so we can't observe tradeoffs that the person is willing to make. Economists have developed what are known as "stated preference" approaches to measure these types of values. With stated preference approaches, hypothetical questions that embody tradeoffs are asked, and the responses are used to elicit values. For example, a stated preference approach might ask respondents whether they would vote for a program to reduce nitrogen emissions, with specifically described improvements in Tampa Bay amenities, given that it will increase their electric bill by a stated amount per year. By varying the stated amount across respondents, standard economic methods can be used to infer acceptable tradeoffs between higher electricity prices and changes in environmental amenities.

Stated preference approaches can be applied to use values as well as nonuse values, and are particularly appropriate for evaluating conditions that don't currently exist. For example, suppose there is a beach in Tampa Bay that has been closed for years due to water quality concerns, and managers wanted to know how many people would visit the site if water quality were improved to some specified level. Or suppose managers wanted to assess the value of building a boat ramp at a site where none have ever existed. In this case, we can't directly observe what people would do, since the amenity is not presently available. One could possibly extrapolate from other "similar" sites, if some are available. Or stated preference methods could be applied by asking people how their participation in an activity would change if the hypothesized program were implemented.

Stated preference methods are very powerful, but they also embody considerable peril. The power arises since they can, in principle, be applied to virtually any situation imaginable. The peril arises because responses might indicate something other than that intended by the researcher. For example, a response may indicate symbolic support for environmental programs in general, rather than indicating an acceptable tradeoff for the specific amenity being considered. Or respondents may not know how they would behave without actually experiencing the situation, since it may be difficult to predict how one would behave in a situation that is far from one's previous experience. Thus, one might expect stated preference techniques to be more reliable in familiar situations with choices that the respondent has experienced many times. Unfortunately, the circumstances when stated preferences methods are most needed, where there is no "similar" experience from which to extrapolate, are exactly the situations where stated preference methods are more challenging to apply.

A rigorous survey development process is key to creation of a survey instrument that is understandable to respondents and that elicits the information being sought by managers. A workable survey that elicits the appropriate information requires a two-way communication between researchers and survey respondents.

The survey must pose questions that are meaningful and that elicit the thought process that researchers seek, so that respondents reveal acceptable tradeoffs.

Ultimately, we want to identify values regarding impacts on bay amenities that people care about, and the levels of nitrogen concentrations in the emissions of nearby power plants are not necessarily very meaningful to the public. Available scientific studies will be used to establish the sequence of linkages from specific emission control actions, to changes in nitrogen emissions, to nutrient concentrations in Tampa Bay, to impacts to important natural amenities like seagrasses, and ultimately to populations of important fish and shellfish species, etc. In doing so we face a host of complex and technical issues that stretch our scientific knowledge to its limits. Simultaneously, we face the challenge of getting people to understand the critical issues being faced, and communicating their values. If respondents interpret questions in a manner other than intended by the researcher, survey results can be meaningless or misleading.

We will implement a rigorous development process that includes direct interaction with individuals that are representative of those ultimately to be surveyed. We will carry out survey development and pretesting by giving participants successive draft survey instruments, which are completed by participants, followed by discussion of what respondents thought of the survey, and why they answered questions as they did. This will ensure that respondents are expressing their preferences for natural amenities by making tradeoffs as intended by the researchers. Survey instruments are successively revised in response to feedback by participants, and retested until we are confident that the survey is working as intended.

Depending on the complexity of the issues faced by survey respondents, we may have to go through 10 to 20 draft survey instruments, with time for revisions in between. This process can easily take 3 to 9 months or more to complete. On a difficult topic, such as atmospheric deposition of nitrogen, it can be wise to spend something on the order of 80 percent of the effort developing the survey instrument, and only 20 percent of the effort implementing the survey and analyzing the resulting data. When faced with challenging topics, survey processes are not cheap or easy. Indeed, a "quick and dirty" survey can easily be more misleading than helpful.

Methods for implementing stated preference approaches have been greatly refined over the years. Various categories of biases have been identified, much effort has been placed in attempting to determine whether biases appear to be at issue in particular case studies, and methods have been developed to minimize biases (e.g., Mitchell and Carson, 1989). Although this literature provides guidance, there is ultimately no substitute for a rigorous survey development process that includes direct feedback from people representative of those who will actually be surveyed, followed by successive revisions to draft survey instruments.

We will employ a series of focus groups for this purpose. Focus groups are small discussion groups led by a skilled moderator. Initial focus groups will involve very general discussions of the issues of concern and are used to understand the perspective of participants, to identify how they think about issues, what

language they use, which words are loaded or likely to be misunderstood, what kinds of background information needs to be provided, whether they care about the issue, and if so why.

As the process moves along, more time will be spent concentrating on specific issues identified to be important to the developing survey and pretesting successive draft questions. This latter activity is particularly critical for developing a workable survey. These focus groups will include considerable discussion of the questions, including both broad open-ended questions, such as what participant thought about the survey, and more targeted questions, like what they were thinking about when they answered each individual question, or when they read a particular term, such as habitat or atmospheric deposition. Doing so provides feedback on whether participants understood the question, and whether the logic used in coming to their response is consistent with the thought process that the instrument is attempting to elicit (typically, evaluating some sort of tradeoff). This provides excellent qualitative information that is useful for understanding values held by focus participants. More importantly, it also provides essential insights that help to identify difficulties in survey questions, and suggest approaches that can be used to improve the survey design.

Once a workable survey is created, verbal protocols will be used to complete pretesting process. The verbal protocol method is applied to a single individual, rather than a small group, and asks the individual to think aloud as they fill out the draft survey. The procedure is taped, and a facilitator is generally present to encourage the individual to continue talking if they become silent. This approach has the advantage that respondents don't need to recall what they were thinking when they answered the survey question, there may be less of a tendency for respondents to "rationalize" responses *ex post*. One disadvantage to the verbal protocol method is that the process is self directed, so you can't ask specific questions that might arise, nor do you get the kind of interaction that you might in a focus group, where individuals react to what others say. Also, using focus groups allows feedback from a larger total number of individuals with a given investment of time. Our survey development process will include a combination of focus groups and verbal protocols to get the best of both approaches.

Communicating the scenario in a way that is understandable to survey respondents is a critically important part of the survey process, especially when the commodity is less familiar. Depending upon how the survey is implemented, information can be presented using pictures, drawings, figures, etc. We have become experienced with various visualization tools for communicating scenarios to survey participants. We pioneered the use of videos for providing background information for surveys (Opaluch et al, 1993). Videos have many advantages over written material. People are very used to watching presentations, are much more attentive to a video presentation, and far more capable of absorbing information when presented in a video format than when that same information is presented as several pages of paragraph text. Our experience has found that a well produced video excites participants, and encourages them to get involved in a survey, while presenting the same information as several pages of paragraph text tends to intimidate and sometimes bore, or even alienate respondents. We are also experimenting with new technology-based tools such as digital imagery and virtual reality systems to help participants better visualize scenarios.

Depending upon the level and complexity of background information needed, we will be considering using a video to present background information. Although videos can be expensive to produce, modern computer technologies have contributed to significantly reducing the cost. For example, a Powerpoint presentation of background information can be developed and refined through the focus group process. During survey development, the successive draft scripts can be read to focus group participants while they watch the visuals in the presentation. Once the presentation is completed, the script can be recorded and linked to the appropriate slides in the Powerpoint presentation, which is then shown to respondents prior to taking the survey. Or the presentation can be turned into a video, either by exporting the presentation directly to video tape, or by creating a video production using Powerpoint presentation as a “proof”.

This greatly reduces the cost of creating an audio-visual presentation for providing background information. However, this somewhat complicates the logistics of survey implementation, and places limits on venues in which the survey can be implemented. Nevertheless, we will develop an audio-visual presentation if we find that a considerable amount of complex background information needs to be presented to respondents.

It is important that the question make the degree of environmental improvement clear and relevant to survey respondents. In many cases, a format that seems perfectly clear to “experts” is not at all meaningful to the general public. And conversely, in some cases question formats that seem confusing to “experts” can be perfectly clear to members of the public. We will carefully pretest surveys to make sure questions are clear to respondents.

The information presented and the question format used must both be meaningful to respondents. For example, presenting environmental improvements in terms of nitrogen concentrations of power plant emissions would not likely be meaningful to respondents, since they would not likely have an understanding of the implications for the critical amenities in Tampa Bay that are valued by respondents. Respondents would likely answer the questions, but the responses would not indicate values for Tampa Bay amenities if respondents don’t have the information needed to make the linkages to species of concern. Rather, respondents would ideally be given information on changes in populations of important species, for example, relative to “no action” levels. Clearly, successive pretesting of draft formats for this information is critical for developing a workable survey.

In our focus groups, we will consider several alternative question designs to find which one works best with respondents. For example, we will test a “referendum” format, where we ask respondents whether they would vote for a program to control nitrate deposition at a stated cost that results in a stated improvement in Tampa Bay amenities. By varying the stated payment, one can identify the percentage of respondents who indicate that they would vote for the program at each amount, then estimate a “mean” (or median) willingness to pay for the program. Use of a mean willingness to pay is based on the notion that those who favor a policy could potentially compensate “losers”, and all parties could be made better off. However, actual compensation is rare.

Use of a median willingness to pay is analogous to voting, in that it identifies programs that would be supported by 50% of the respondents. If the cost of the program is less than the median willingness to pay, the survey results suggest that the proposed program would pass a referendum. By varying the stated environmental improvement and the cost, one could identify percent of the public that would support different programs, providing useful input to management committees.

We will also use focus groups to pretest a conjoint format for questions, where complex commodities with several attributes are presented to respondents. The term "conjoint" is derived from the fact that the attribute levels are considered jointly by survey respondents. For example, a conjoint analysis could specify a multifaceted program for environmental protection, where the attributes describe stated levels of protection for different amenities (e.g., birds, manatees, fish, etc.) in Tampa Bay at a stated cost. Some programs might be more protective of certain fish species, while other programs might be more protective of birds or marine mammals.

By applying a statistical design over the levels of the attributes, the results of the survey can be used to identify the relative importance of each attribute to the respondent. If one of the attributes is dollars, then researchers can elicit the importance of each attribute relative to monetary payments, so that monetary values can be calculated. However, conjoint methods can also be used to measure relative values of different amenities, without dollar values, and decision makers can use the resulting information to determine the public's stand on the best set of resource protection actions to implement within a given budget.

We will consider alternative designs for conjoint questions. For example, respondents could be asked to rate different programs that provide varying levels of protection for different species, or they could select the program that they prefer. Frequently conjoint analyses are set up as paired comparisons, where respondents are presented with two options, and are asked which of those two options they prefer. For example, the options might be two different beaches, each with a given sets of attributes (e.g., facilities, distance, entrance fee, etc.). Respondents then might be asked which of those two are preferred. So one beach might be more expensive, but have better water quality. Presenting respondents with choices like these can help to identify acceptable tradeoffs for respondents. Or one could specify alternative programs for protecting and restoring natural amenities, each with different levels of protection for each amenity and different costs. This can be used to identify the public values and priorities for programs to protect various environmental amenities, which provides input of direct relevance to policy makers.

The paired comparison approach has an additional advantage of presenting respondents with a more balanced choice. So instead of asking how much the individual would pay for a stated amenity, where the respondent is explicitly asked to tradeoff dollars for an amenity, respondents are instead presented with two alternative programs, and asked which program they prefer (and they may be allowed to indicate that they prefer "neither program"). Identical tradeoffs may be implied, but the task being carried out by the respondent is different, and one approach could be more effective in eliciting the information that the managers need to support their decisions. In determining which approach is more effective, there is no



substitute for succession of pretests that include direct feedback from individuals who are representative of the ultimate sample, and subsequent revision of the survey.

Frequently, scientific experts, resource managers and the public alike express skepticism for the whole notion of placing dollar values on environmental amenities. The conjoint approach has the advantage that it can be used to identify relative values or priorities for different environmental amenities. The could be useful, for example, in determining the best set of actions to be undertaken with a fixed budget, without placing dollar values on environmental amenities. Yet if conjoint questions include a stated program cost as an attribute, conjoint result can also be used to place dollar values on amenities, if desired.

We will place considerable emphasis on making questions as realistic and familiar to respondents as possible. Also, we will take steps to ensure that respondents believe that there are real consequences to the choices expressed in the survey. For example, respondents might be told that the results of the survey will be passed on to policy makers who could base policy upon the results of the survey. We will also work closely with managers to ensure that the results are expressed in a way that is mostly useful for managers.

The results of an our economic analysis will allow us to base policy recommendations on something approximating a referendum, but doing so in survey form provides more flexibility. For example, an actual referendum would, of necessity, pose only one level of provision of the amenity at one stated cost. However, a survey could specify different levels of provision and different costs, either in different questions to a given individual or across individuals. So, for example, one might find that a majority of the public would not support a program that improves water quality to "pristine" levels at a great cost, but they would support a more modest program that achieves a lower, yet still beneficial, level of water quality at a far lower cost. Or a series of questions might help managers identify the percent of the public that would support alternative programs that focus on different amenities and that vary in terms of cost and environmental effectiveness. This could provide resource managers with a great deal of very useful information regarding public values for potential programs.

The next stage in the research is to implement the studies. There are many technical issues related to implementation and data analysis. However, while important in obtaining accurate and reliable measures, these issues are not directly related to the task at hand. This discussion focuses only on issues related to sampling and carrying out "rationality tests" on the results of the final survey.

Ideally, surveys should be implemented using probability sampling, which provides samples that are representative of the population of interest. However, probability sampling procedures can be very expensive, and may be beyond available budgets. To the extent that sampling procedures imply a non-representative sample, efforts will be made to identify and correct for this problem. For example, it is often found that response rates are higher for respondents who are wealthier and better educated. In such a case, it is fairly straightforward to use weighting procedures to correct for this type of non-representative sample. It is more difficult to correct for biases that might result from, for example,

samples that are non-representative in terms of environmental concerns, or other factors that cannot be easily identified and corrected using standard demographic information for the population at large. However, note that similar issues are faced with voting processes.

A major concern with results from valuation surveys is whether respondents indicate values for the specific commodities described, versus whether responses indicate “symbolic” concern for environmental amenities, in general. As discussed in detail above, we will make considerable effort in our survey development process to develop questions that elicit well defined values for specific amenities. We will also design our survey instrument so that it is amenable to various “rationality tests”, including scope tests (e.g., NOAA, 1993) and additivity tests (McFadden and Leonard, 1993). that can be used to confirm that the survey was successful in avoiding symbolic responses. Scope tests compare stated values for more inclusive versus less inclusive amenities. If survey results are “symbolic” one would expect to find that values do not vary with the commodity specification. In contrast, if results are well defined amenity values, then one would expect to find higher values associated with more inclusive commodities.

Additivity tests are more rigorous rationality tests, whereby the value for a composite commodity is compared to the values of the component parts. So the total value of two commodities obtained together should be equal to the value of the identical commodities obtained sequentially.

Given a set of results, economic studies can be linked to scientific analyses to determine public values associated with alternative management policies. For example, economic studies might determine how the number of recreation days and the value per day vary with water quality. Scientific studies could be used to determine how water quality and fish populations could be affected by management actions. By linking these studies, we could determine how the values of recreational swimming and fishing are affected by a stated policy aimed at improving water quality. Similarly, one could determine how policies to protect and restore manatee populations contribute to the associated non-use values.

## **Summary**

Economic methods can be used to measure values and provide direct and quantitative input into difficult decision problems, such as environmental management decisions in Tampa Bay. Economic methods provide public input into management decisions that is analogous to voting processes, particularly when median, as opposed to mean, values are applied. In such as a case values are measured for a "representative" (median) member of the public, which can be used to indicate which programs would pass a public referendum.

Being analogous to voting processes, and economic methods have similar strengths and weaknesses. In terms of weaknesses, the public is not necessarily the best informed of all parties about environmental issues. Difficulties are faced in both cases regarding informing the public of the implications of policies being

considered. Also, there can be other problems implementing both voting processes and economic methods, such as obtaining non-representative samples, etc.

Although analogous to a public referendum, surveys are far more flexible and can be designed to provide more information to managers. For example, surveys can pose different levels of protection of natural amenities, different amenities and different levels for the cost. This can provide a rich body of information regarding the percentage of people that would support a host of different restoration programs, which can provide input into management decisions regarding public values for natural amenities and for programs to protect or restore those amenities. The results can be used, for example, to identify the set of environmental programs that best meet public values, given a limited budget. This information is essential in achieving the state objective of the Tampa Bay Estuary Program to "ensure that increasingly limited public funds are spent in a manner that best benefits the bay and the people who live around it" (Tampa Bay Estuary Program (1998)).

Economic methods can also help managers understand components of value. For example, economic methods can be used to identify values associated with specific amenities, and various dimensions (e.g., quality versus quantify) of amenities. Methods can also estimate use and non-use values, so we can find whether values are associated with specific activities that utilize the resource, or whether nonuse values dominate, so that values are associated with existence of the amenity in its own right, above and beyond human use.

However, measuring values for complex commodities such as environmental amenities is an inherently difficult task. A thoughtful and rigorous research process is a critically important component of obtaining meaningful value estimates. Methods must be flexible, and with specific design decisions made as part of a two-way communication between researchers and the public. The program team must have the experience to adapt the direction of the research and fill information gaps as necessary to meet the program needs and in order to identify the best means for eliciting values.

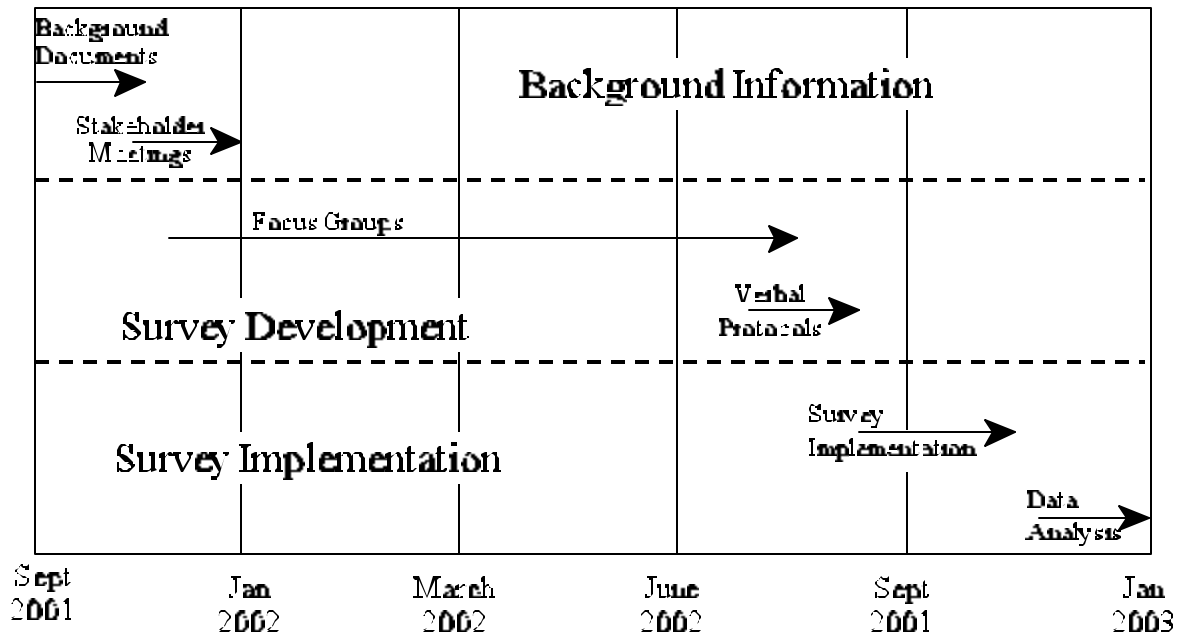
This underscores the need for a strong research team, with strong experience and training. It also reinforces the need for an adequate time and budget to carry out the process. So it is important to include economists early on in the research, so there is adequate time to implement the necessary stages of the process. Quick and dirty surveys can be more misleading than informative. But a thoughtful survey can provide essential public input into public decision processes, and are well worth the cost, especially given that government managers are spending public funds, and are therefore mandated to act as trustees for the public.

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## Tentative Project Timeline\*



\* Note timeline excludes analyses of specific policy options. These would be coordinated with managers and scheduled for completion of supporting science studies.

## Budget\*

Dates: 01-Sep-01

01-Jan-03

### Personnel Costs

Senior Professionals	400 hours @	\$150	\$60,000
Junior Professionals	300 hours @	\$75	\$22,500
Research Associates	1000 hours @	\$35	\$35,000

\$117,500

### Supplies

Document Purchases	\$500
Focus Group Materials	\$3,500
Survey Printing and Distribution	\$5,000
Telephone	\$500

\$9,500

### Travel

Meetings with Key Personnel	\$5,000
Focus Groups	\$3,000
Survey Implementation	\$2,500

\$10,500

Total \$137,500

\* Budget includes all activities except for assessment of specific management activities